CHAPTER VIII:
CONCRETE LAUNCHES

Ramps, Stairs, and Mats

Concrete has a variety of applications that include ramps, stairs, mats, and strips. Some applications, such as stairs, are cast-in-place, where the concrete is poured and shaped on site. Others are composed of pre-cast mats, planks, panels, or slabs. Concrete can also be used to create strips that help to control erosion or to divert heavy flows away from a launch site.

Concrete may be purchased as a ready-mix (generally used for smaller projects) or delivered by a mixing truck. For cast-in-place ramps, approximately 0.37 cubic feet of mix are needed for every 10 cubic feet to be cast.

The basic mix for concrete consists of 1 part cement, 2 parts sand, 3 parts gravel (or aggregate), and water. Proportions can be altered to suit the needs of the site. For example, a higher proportion of cement can be used for thinner structures, while thicker launches may require more aggregate.

Portland cement (composed of ground limestone, clay or shale, sand, and iron ore) binds the materials together, hardening the mix, while sand and aggregate act as “fixers” to control the mix from shrinking. Water reacts with compounds in the cement as it hardens and allows for plasticity so that the concrete can be poured into a form and shaped.

Additives called admixtures can be added to concrete mixtures either to improve the quality of the mix or to keep the concrete workable in certain climatic conditions. Air-entraining agents, which are bubbles added to the concrete mix to improve its durability, may prevent cracking as a result of freezing and thawing cycles.

CONCRETE RAMPS

A. General Description

Concrete ramps may be used as launches by themselves or in combination with floating launches, piers, bridges, dock abutments, bulkheads, and rock cribs. If the ramp connects to a floating launch using a bridge, it will need a hinged metal transfer plate to allow for an easier transition.

Concrete must be installed in dry conditions, therefore the area must be totally clear of water where any portion of the ramp extends beneath the surface of the water. The underwater area may need to be cofferdammed. A cofferdam is a water-tight enclosure that is temporarily used to pump water out of an area during construction. If lime is used in this process, it must be managed carefully so as not to enter the water where it can pose a danger to riparian species.

Pre-cast concrete planks and panels should only be used on bodies of water with little to no current. Pre-cast slabs are heavy and must be placed using lifting equipment; reinforced concrete is typically needed for underwater sections of the pre-cast ramp.

B. Materials

Surface finish, including corrugated concrete, rock salt, or exposed aggregate, may be applied to concrete to increase traction or improve its appearance. One popular finish uses 1" x 1" V-grooves formed at a 60 degree angle to the centerline. V-grooves should not be used on launches that serve as accessible routes, however, as they make wheelchair access difficult.

C. Design variations/specifications

- The width and thickness of concrete ramps vary, but cast-in-place ramps are typically 6" to 8" thick and use rebar reinforcement
- Ramps can be cast-in-place or composed of connected pre-cast slabs, planks, or panels

D. Advantages

- Provides the most stable, sturdy surface for launching
- Durable; not subject to rot or rust
- Easy to shape and work with, adaptable to slope needs; minimal additional construction needed
- Can be relatively inexpensive to construct, depending upon type of application
- Relatively low maintenance (depending on sedimentation levels); easy and inexpensive repairs
- Can be used to help mitigate erosion problems or assist with vegetative restoration

E. Disadvantages

- Can cause damage to riparian ecology, preventing growth of vegetation and impacting habitats
- Surface can be slippery, especially when muddy or wet, however, using corrugated concrete, rock salt, or exposed aggregate on the surface can provide effective traction
- Can be damaged or crack easily due to freezing and thawing conditions, but can also be easily and cheaply repaired
- Can be expensive to clean if there is heavy flooding and mud build-up
- Usually not aesthetically "pleasing," although their noticeable presence can assist paddlers with locat ing take-outs from the river. They can also be surfaced for an improved appearance with materials such as river rocks, fieldstones, or salt-finishing

F. Case examples, designs, photos

1) Wolf Creek, Missouri River, Montana

Problem: The original launch, installed over 25 years ago, was a pre-cast concrete ramp that angled downstream and extended out into the water approximately 10 feet. Due to its configuration, eddies formed and the fill supporting the ramp eroded, over time, due to undercutting. Undercutting is a frequent problem with ramps that are not built at a perpendicular to the shoreline. Areas of vegetation at the top of the ramp had also eroded with use by paddlers loading and unloading their boats.

Solution: Engineers at the Montana State Design & Construction Bureau rebuilt the ramp to make improvements for safety, longevity, and ease of use. The original intention was to reorient the alignment of the ramp to be perpendicular to the bank. However, fearing that the new ramp would encourage jet boat traffic, they decided to build it on the same location as the previous ramp.

The new concrete ramp is wider, elliptical in shape, and thickened with a 24" concrete edge along its perimeter to prevent undercutting. The previous pre-cast concrete planks were replaced by flexible, cabled concrete mats and its slope is around 1:3. Its textured surface provides traction. Rip-rap and textured bank protection were also added.

A 6" concrete slab with fiber mesh and 12" thickened edge was also added to provide a relatively flat section at the top of the ramp where paddlers load their boats. By giving paddlers a designated area to use rather than trampling vegetation, the ramp helps to decrease erosion in areas around the launch.

Photo 8A, 8B: An elliptical concrete ramp was installed at Wolf Creek, on the Missouri River, to reinforce the bank and provide a loading area for paddlers in a way that helped mitigate erosion

Photos courtesy of Ken Phillips
Montana State Design and Construction Bureau

2) Salida boat ramp, Arkansas River, Salida, Colorado

Salida's concrete boat ramp is an example of a launch site that has helped contribute to the revitalization of a town. Before this launch was installed a few years ago, this corridor of the Arkansas River was both inaccessible and unfriendly to paddlers and the general public. The area had been severely neglected and had become a depository of debris and waste from industrial sites upstream.

Part of the Arkansas River Trust's Whitewater Park and Greenway Project, installation of this boat ramp has helped to transform this spot into a popular one for launching, fishing, and other river-based activities. Native vegetation has replaced hundreds of tons of concrete along the banks and a whitewater course now offers a quarter mile of quality rapids on the river.

Photo by Caroline Wolf

Photo 8C: Salida's concrete launch offers river access for a variety of recreational activitites

3) Corrugated concrete ramp, Everglades, Florida

Photo by Tim Palmer

Photo 8D: Corrugated concrete ramp provides effective traction for launching

CONCRETE STAIRS

A. General Description

Concrete stairs are particularly effective in providing access along steep shorelines. They are durable and easily maintained and may be used in areas where water levels change dramatically, as they are likely to withstand currents and offer acess at a range of water levels.

B. Materials

Stairs are formed from concrete that is poured on site. Once a bank is prepared to accommodate the stair dimensions (which may require some digging out with equipment, such as a backhoe), a concrete foundation is created, which is reinforced with rebar or metal. Molds are created for the stairs and concrete is poured into them. After the forms are set, the molds are removed.

C. Design specifications/variations

- If steps are tapered in width as they descend to the water, the bottom steps should not be too narrow; paddlers need at least 5' and preferably 6' to 12' for launching
- Handrails may be needed to provide additional support for paddlers where shorelines are excessively steep; they may not be needed in areas with shorter distances to the water or less dramatic slopes
- Installing a 4' to 8' landing pad at the bottom of concrete steps can be useful to paddlers; this may serve as a “seal launch” where kayakers can put on their spray skirts before launching

D. Advantages

- Provide effective solutions to a steep slope or eroding bank
- May be more aesthetically pleasing than concrete ramps or mats
- Can be combined with boat slides to provide easy transport of boats to water
- Require relatively little maintenance; durable

E. Disadvantages

- May not be as easily accessible as concrete ramps or other launch types
- Can be expensive
- Rarely provide access for disabled paddlers
- May require artificial shoring (usually upstream) to protect them
- May require use of heavy equipment for preparation of bank before installation

F. Case examples, designs, photos

1) Concrete stairs, West Virginia

West Virginia Department of Natural Resources provides an example of a concrete staircase with a raised, wooden boat slide. The boat slide enables paddlers to keep their boats at knee-level, so that they don't have to bend down, as they descend the staircase. The staircase is durable, projected to last at least 15 to 20 years. Little maintenance is needed, although there can be problems with mud accumulation at its base.

Specifications:

- Two staircases with boat slide in center; stairs lead to a ramp extending to water
- Each staircase is 2' wide x 24' long with twenty-four concrete stairs;
  each staircase measures: 24" wide x 12" long x 6¼" high
- Stairs are reinforced with #4 rebar, each 3' long, spaced 1 foot apart
- Boat slide descends center of staircase and is raised 1' above the height of the steps
- Slide is composed of two parallel boards made of pressure treated oak;
  each board measures 6" wide x 24' long x 2" thick; total width of slide spans 2½'
- Steel pipe handrails run down outer sides of each staircase
- Banks on either side of staircase are reinforced with stone rip-rap with geotextile fabric beneath

Design details for concrete steps and boat slide

Courtesy of Dennis Kincer, West Virginia Department of Natural Resources

DIAGRAM 8A: Details of boat slide

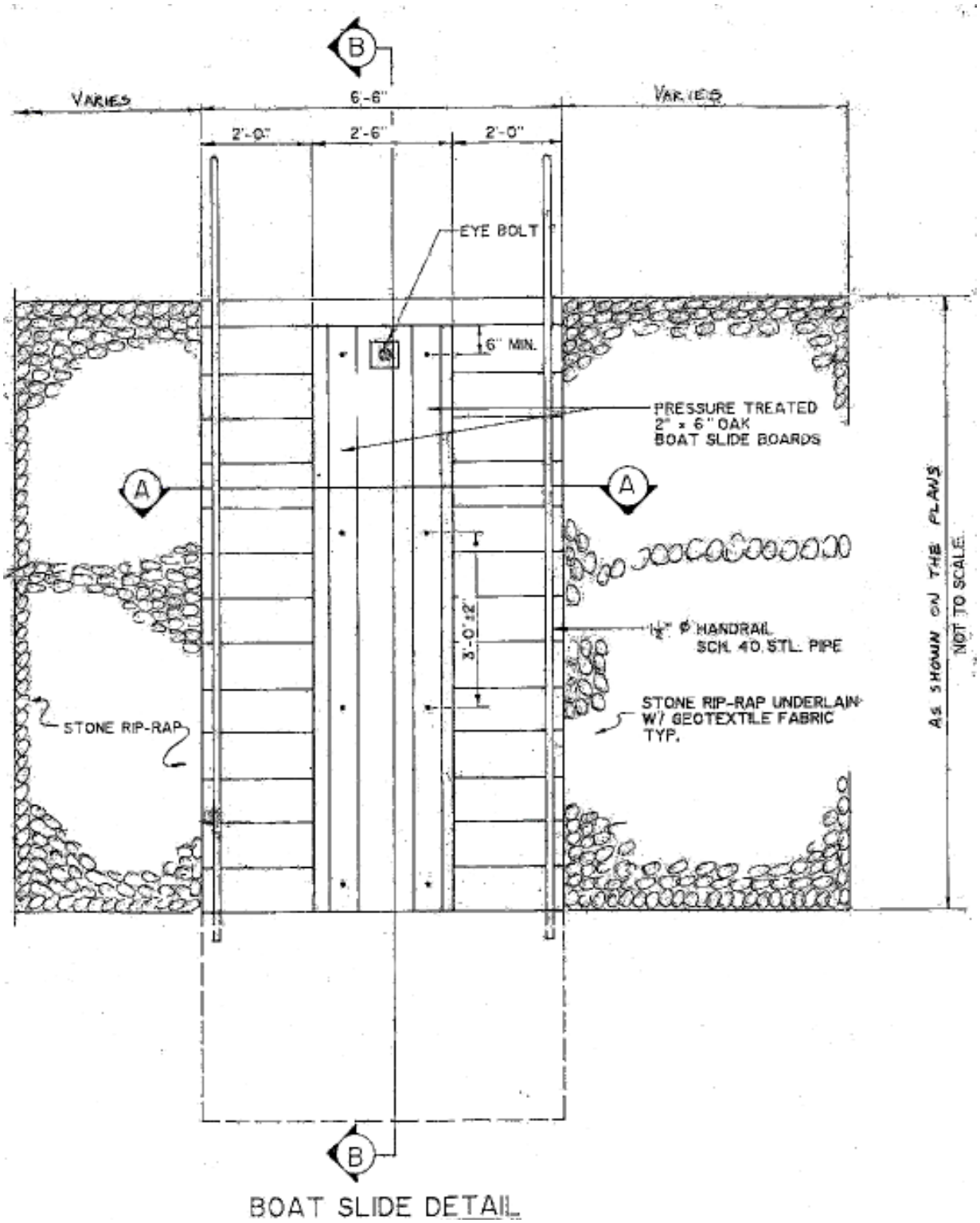


DIAGRAM 8B: Section elevation of concere steps and slide

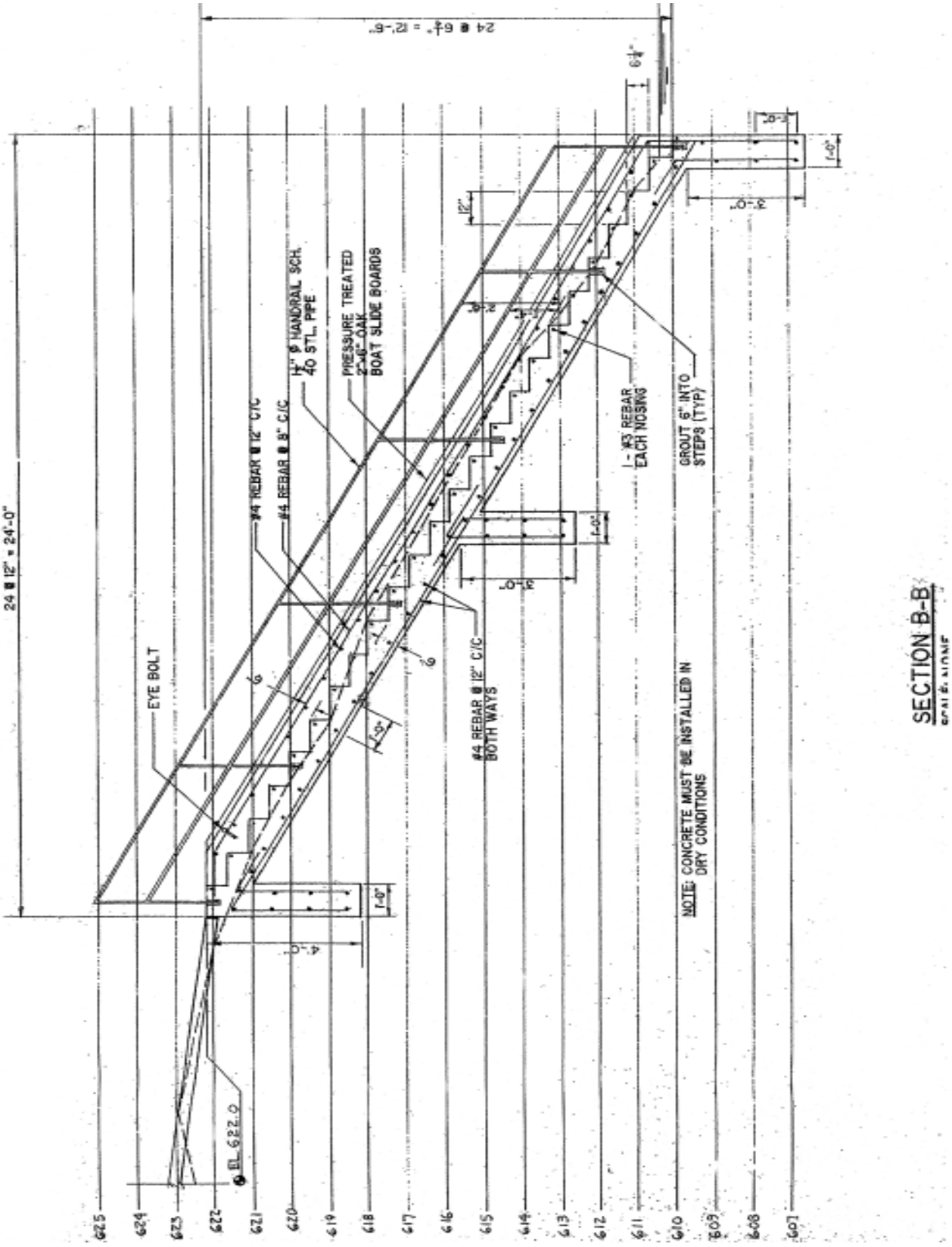
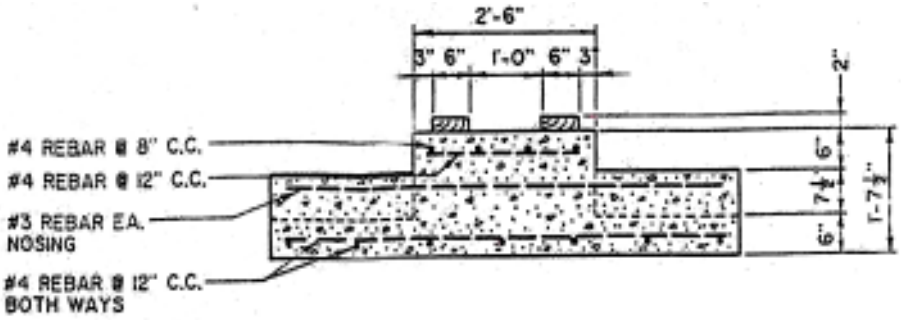
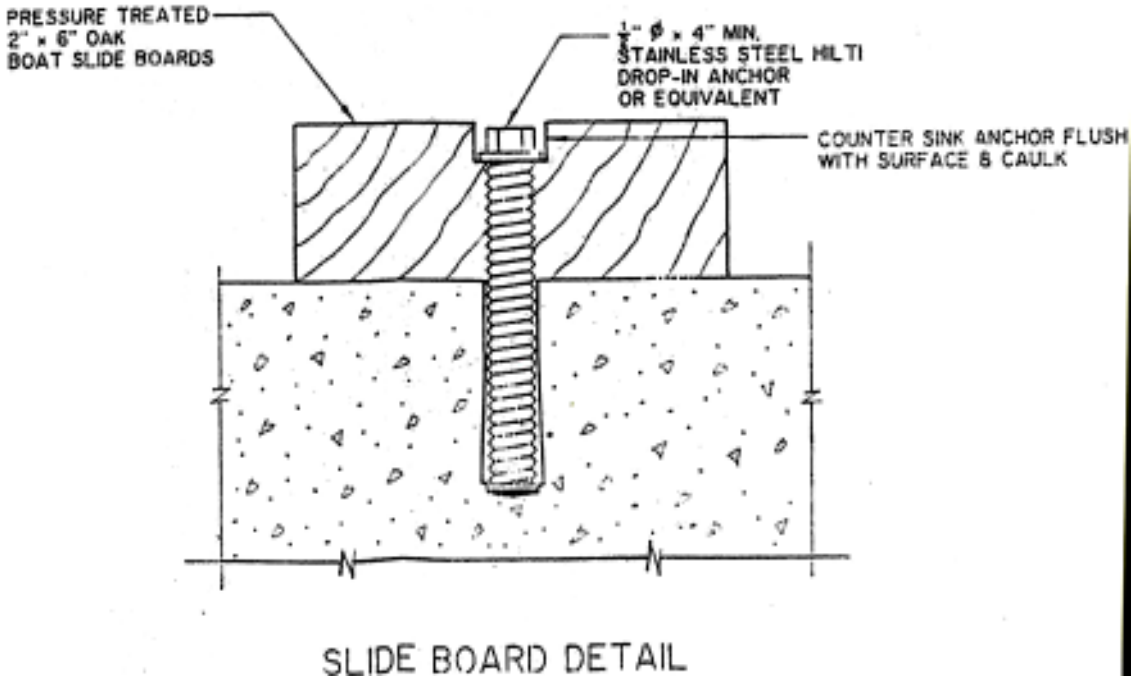


DIAGRAM 8C: Section A-A and detail of slide board



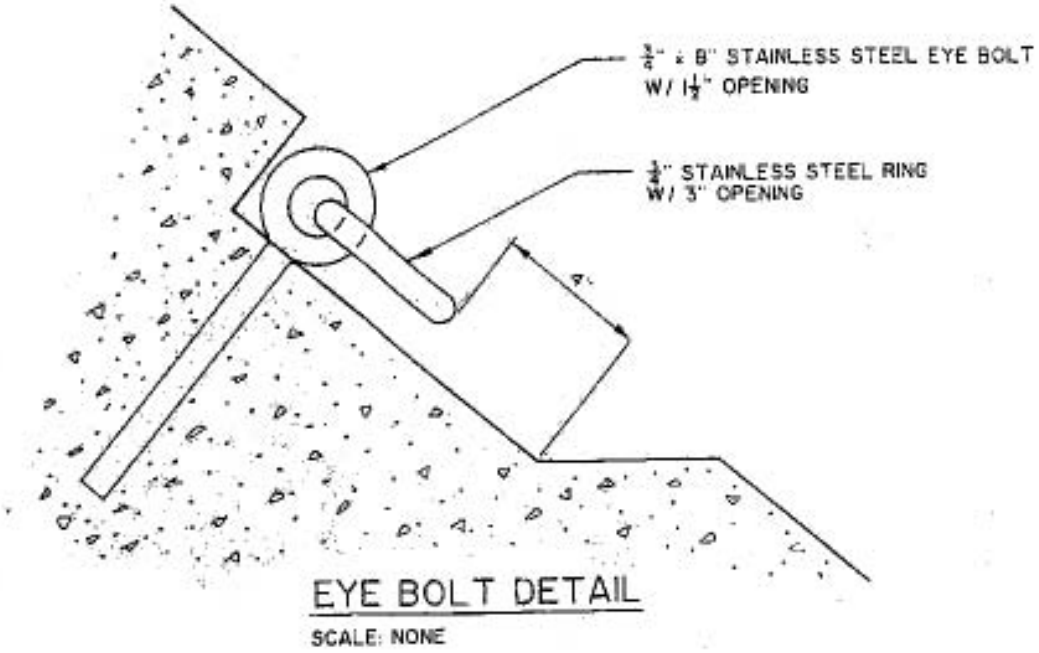
SECTION A-A

SCALE: ½" = 1'-0"



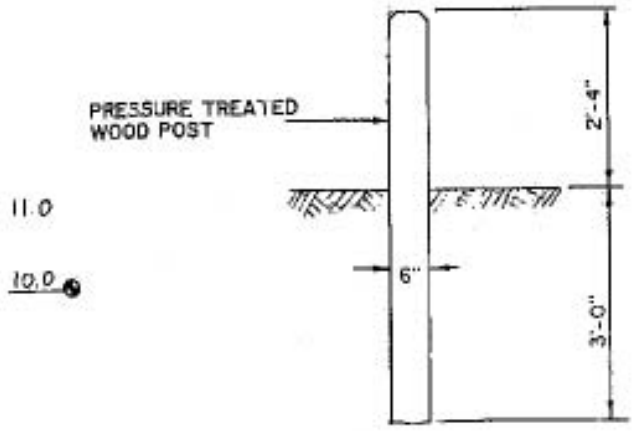
SLIDE BOARD DETAIL

DIAGRAM 8D: Detail of eye bolt and guard post



EYE BOLT DETAIL

SCALE: NONE



GUARD POST DETAIL

SCALE: ½" = 1'-0"

2) White Rock Park, Colorado River, La Grange, Texas

Developing an ADA accessible launch site on an excessively steep slope can prove difficult, particularly if the slope cannot be leveled, due to the type of terrain, to meet ADA standards of 8.33%. However, providing at least one accessible route to the launch area can at least make the site more accessible to paddlers with disabilities, who may be able to maneuver the transition with some assistance. This is clearly not a preferable accommodation, however, and every attempt must be made to make the launch site entirely ADA accessible.

At White Rock Park, an accessible route was developed as far as the top of a concrete stairway launch area by leveling a 40' cutback to 10' through several switchbacks along a concrete trail. Every 30 feet or so along the trail, level resting points have been installed to accommodate wheelchairs. The actual launch, a concrete staircase, is clearly not ADA accessible, however it was needed to accommodate the short 10' drop to the water and to withstand mud accumulation after flooding. An ADA accessible transfer plate, or level platform, adjoins the staircase, providing an area where one can dismount a wheelchair and either lower themselves down the staircase or be assisted to the with their boat.

Photo courtesy of Roger Lewis
Lower Colorado River Authority

Photo 8E: Steep shoreline grade prevents site from being entirely ADA accessible; Concrete staircase provides access at base of ADA accessible trail

Designs for White Rock canoe launch

DIAGRAM 8E: Section view of launch area

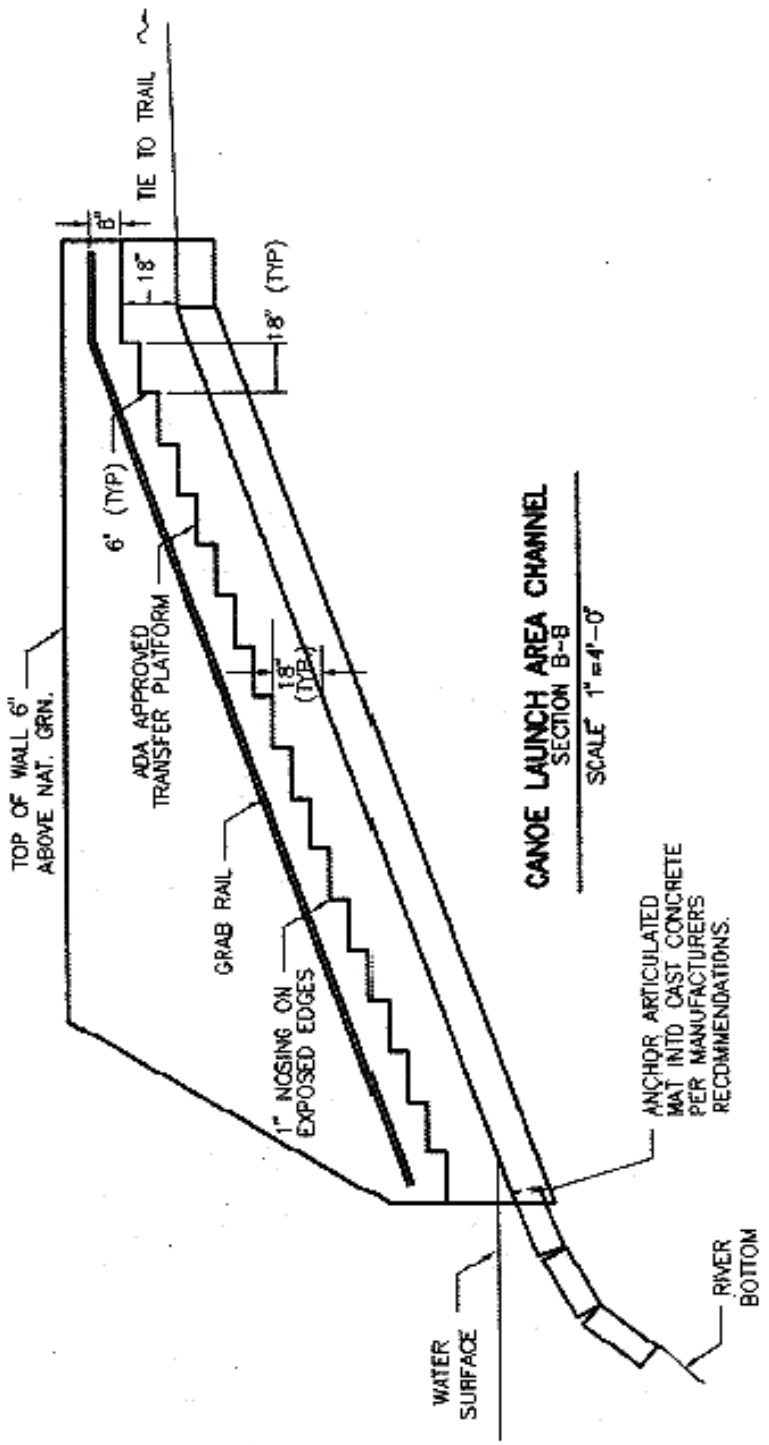


DIAGRAM 8F: Plan view of ADA transfer platform
White Rock canoe launch

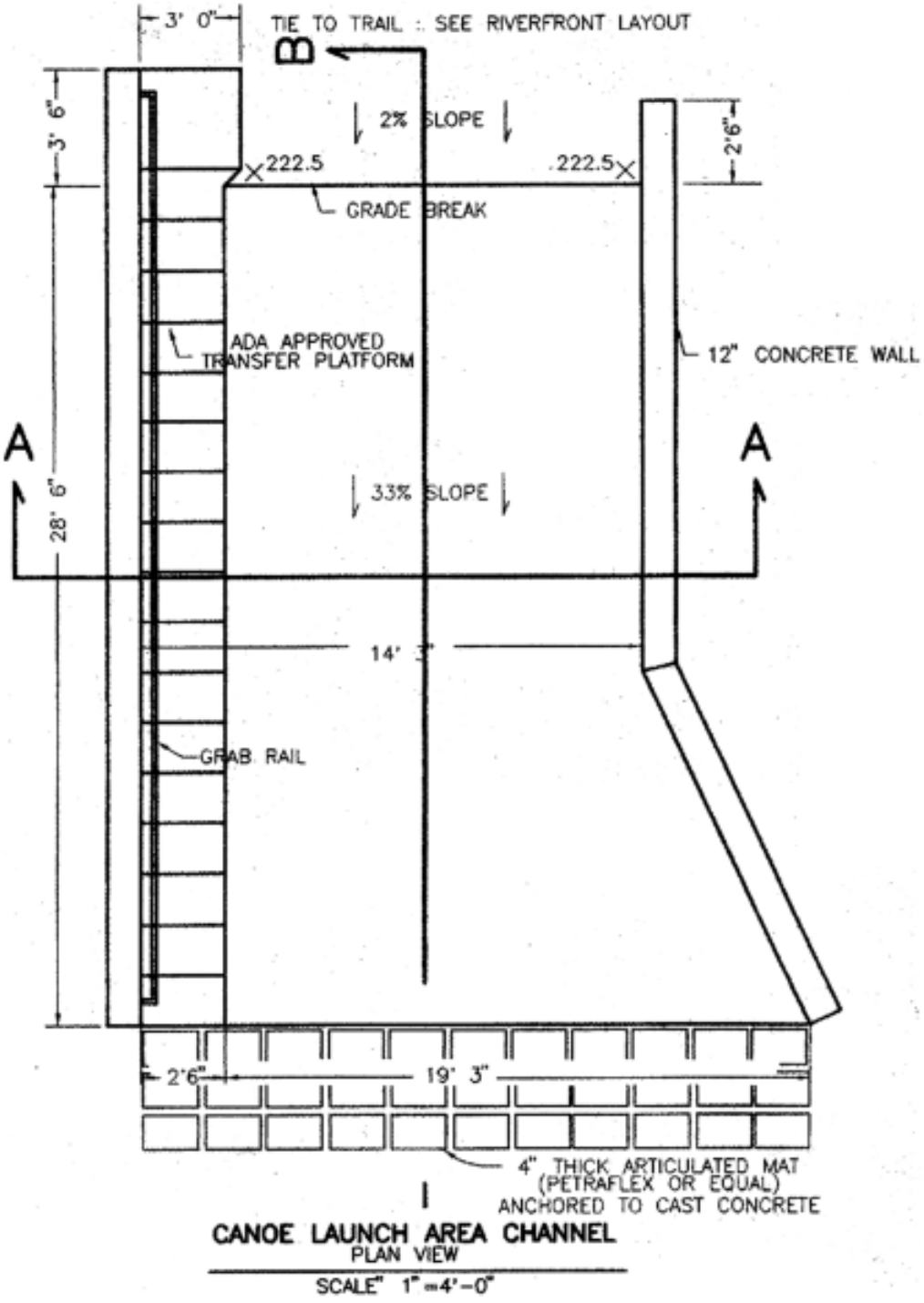


DIAGRAM 8G: Section view of ADA platform
White Rock canoe launch

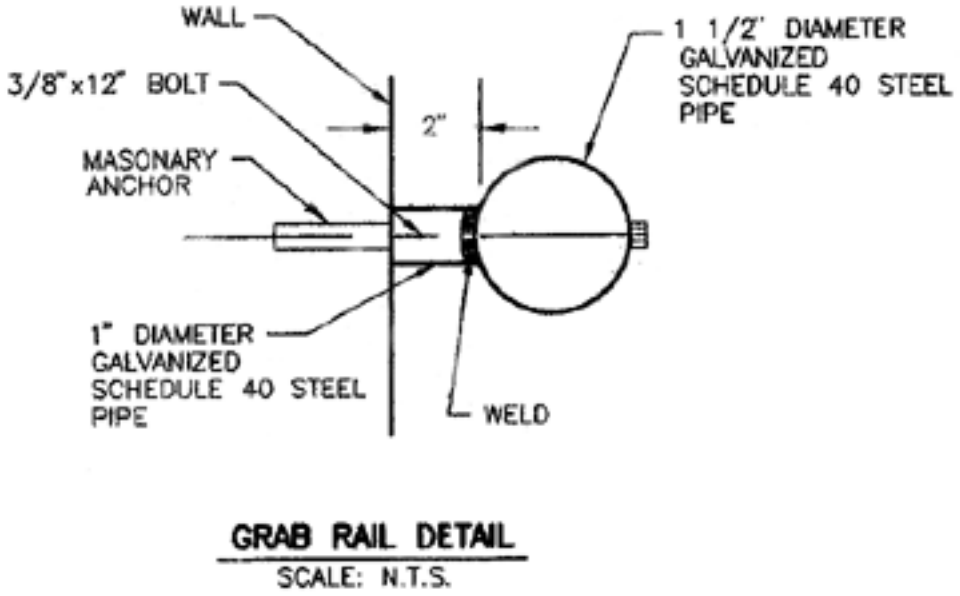
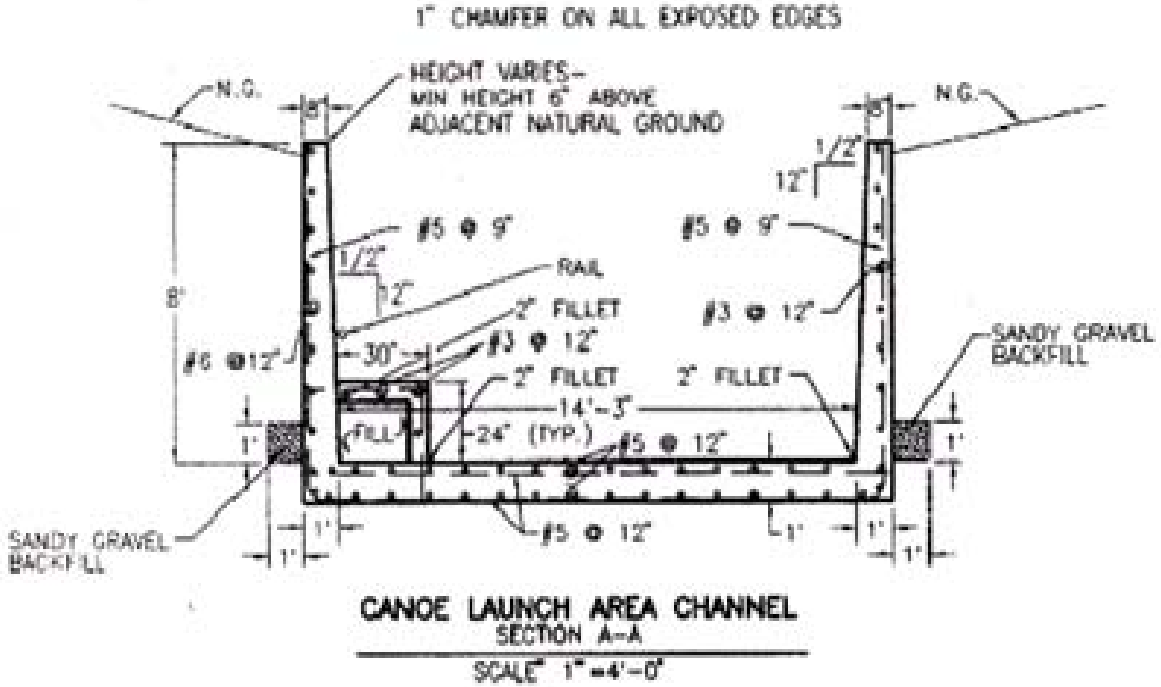


DIAGRAM 8H: Detail of grab rail



3) Concrete steps at Confluence Park, South Platte River, Denver, Colorado

At the confluence of two rivers in downtown Denver, sets of concrete stairs offer access to whitewater chutes at varying water levels. The whitewater course is part of a revitalization project along the South Platte River that began in the mid-1970s.

Photos by Caroline Wolf

Photos 8F, 8G: Concrete steps provide access to different levels of rapids along the South Platte River

Photos by Caroline Wolf

NOTES

CONCRETE MATS

A. General Description

A concrete mat is a oncrete mats may not be the most practical choice for launch sites that mainly serve paddlers; they are more suitable for sites where access is shared with motorized boats.

B. Materials and C. Design specifications/variations

Concrete mats may be applied to a shoreline without significant alteration to its slope. Articulated mats follow the changing slope of a bank and do not require cutting or filling. They are supplied as mats, up to 8' wide, that interlock as they are being placed. Their installation usually requires heavy equipment, such an excavator with a spreader bar, or a crane. They are typically delivered to a site on flatbed trailers.

Placing concrete mats may require some underwater preparation, as the ends of the mats are often submerged in the water, depending on the slope. Submerged areas may need to be sub-excavated and filled with a leveling course, such as washed gravel. If the bank soil is soft, it may require extra protection; an engineering fabric can be added or sub-excavation can be increased, along with the gravel leveling.

Bank surfaces may need smoothing, so rod readings may be used, with the water serving as a leveling device. The first mat (usually the center one) should be placed carefully, as it is needed to align the others. Once the remaining mats are set, they interlock with each other. When all mats are in place, the loops on the upper end of the mats are pulled, using an excavator, to tighten the mats together. Loops are clamped off, clamped loops are buried, and pea gravel may be spread over the mats to fill in-between the blocks, stabilizing them. Additionally, the sloped outside edges of cable concrete may be backfilled.

E. Advantages

- Since they are pre-cast, concrete mats will not need to be poured in areas that are submerged; cofferdamming is not required
- Cutting or filling the bank is not necessary, as it might be with a concrete ramp that needs to be poured at a steady grade
- Since there is less risk of deposition from the cut or erosion of the fill, there is less need for regular maintenance
- Concrete mats typically have soil or gravel between the blocks and are therefore less “developed” or intrusive to a natural shoreline than poured concrete
- If erosion becomes a problem, concrete mats can adapt to changing bank structures; if supporting soil is washed away, blocks may slide downwards and provide protection to eroded areas

F. Disadvantages

- Typically are more expensive than concrete slabs
- Are heavy (an 8' x 26' mat weighs approximately 5 tons) and require heavy duty equipment to install
- Installation can damage to shoreline vegetation, when heavy equipment is used
- Can disrupt “natural” look to shoreline; may not be considered aesthetically pleasing

Geotextile mats may be a less costly or disruptive alternative to concrete mats (*see Chapter XI*).

G. Case examples, designs, photos

1) York Bridge, Missouri River, Montana

Problem: York Bridge was initially a motor boat launch site that was also popular for canoeists, mainly due to its location above a backwater. Due mainly to heavy boater usage, there were a number of erosion problems along the shoreline.

Solution: Slopes on the downstream side of the detention basin were smoothed and reinforced with an articulated concrete mat, and an existing ditch was filled in order to widen the launching area. Articulated concrete was chosen as an alternative to rip-rap in order to mitigate erosion while providing an alternative access to canoeists. This enables canoeists to launch without competing with motorized boaters for space. Additionally, an access road (approximately 150' long and 12' wide) was installed to serve a dual purpose: while providing access to canoeists and small boaters, it also makes the detention basin easily accessible for maintenance purposes.

Photo 8H: Gravel road provides access to both the launching area and a detention basin used for maintenance purposes

Photos courtesy of Ken Phillips, Montana State Design and Construction Bureau

Photo 8I: Articulated concrete launch helps to mitigate erosion while providing paddlers with a separate access site from heavy boat traffic

2) Concrete mat installation, Stickney Creek, Montana

Photo 8J: Concrete mats are installed individually

Photo 8K: Crane is used to place and interlock mats

Photos courtesy of Ken Phillips
Montana State Design & Construction Bureau

NOTES

CONCRETE STRIPS

Poured on site to fit the desired specifications, a concrete buffer or strip may be installed divert heavy flow or sediment loads away from a launch area.

1) Hecla Junction, Arkansas River, Salida, Colorado

Problem: Due to its proximity to an extensive drainage area, the popular launch area at Hecla Junction was continually flooded when combined irrigation waters and spring runoff brought heavy flows and sediment loads. The area was heavily scoured, and a deep ditch formed.

Solution: A concrete strip, approximately 2' wide and 90' long, was installed at the base of the drainage area before it drops off into the beach launching area. Water is forced to flow over the strip, preventing a deep channel from forming. The strip interrupts the strength and velocity of the flow water to flow over it, preventing formation of a deep channel.

Photo 8L: Drainage area adjacent to launch site carries heavy flows during spring runoff and causes scouring

Photo 8M: Concrete strip helps to divert flows away from launch site

Photos by Caroline Wolf

NOTES

CHAPTER IX:

STAIRWAY VARIATIONS

TIMBER STAIRCASES

A. General Description

Staircases composed of timber steps may be cost effective alternatives to concrete when working with a launch site along a steep shoreline. Timber can be easily cut and shaped to meet site specifications and may be built into a steep shoreline in a variety of manners, depending on a site's needs. For example, timbers cut into rectangular or cylindrical piece could be installed from the bottom of a slope upwards, stacked one upon another, in order to reinforce an eroding slope.

B. Materials

- Timber, typically pressure treated; *see Chapter V for information on using treated wood*
- Reinforcement bars, rebar
- Soil, gravel, or "roadbase" (mixture of rough soil and class 6 gravel), used as fill
- Retaining walls, rip-rap (as needed)

C. Design specifications/variations

- Stairs may be constructed as boxes built on top of one another, ascending a slope, to help reinforce an eroding bank
- The launch area at the base of the stairs needs protection from excessive currents in order to prevent undercutting; large rocks or a vegetative buffer may be used
- Launch area at base of stairs should provide consistent access to the water, during changing water levels; surface should be sturdy and able to withstand varying flows
- Handrails are most effective when they are 24" to 32" above the height of the steps; it is important that they not be too high or low for paddlers to be able to use

D. Advantages

- Allows paddlers easier access from a steep or eroding shoreline
- Aesthetically pleasing; less disruptive to "natural" shoreline than concrete
- May be easily and inexpensively repaired, if damaged

E. Disadvantages

- Installation may be costly and may require alteration to shoreline
- May be susceptible to undercutting
- May require maintenance as stairs age and weather